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Abstract

Although there are strong national differences in people´s rejection of in genetical modification in food production (GM food), research mainly examined sociodemographics and knowledge on GM food as general determinants of attitudes towards GM food. Cultural differences seldom are taken into account, usually there are no theoretically founded hypotheses, which can be tested empirically. In the present paper we formulate specific hypotheses on cultural context effects on rejection of GM food by combining Hofstedes (1997) approach with cultural differentiation to a general belief-attitude model as it is represented in the core of Eagly and Chaikens (1993) composite model. Specific hypotheses are formulated for Westgermany and Greece as cases of contrasting cultural contexts (modern vs. traditional patterns of orientation). We find, that knowledge on GM food has an effect on rejecting GM food only in Westgermany, whereas negative beliefs are more important in determining GM food rejection in Greece. Generally, the attitude structure in Westgermany is more differentiated than in Greece, as it is reflected in more variance explained by knowledge, beliefs and sociodemographic status in Westgermany than in Greece.

1 Introduction

Growing genetic engineering of food products has led to controversial public debate in western cultures. Generally, rejection of GM food seems to prevail but there are marked differences between the nations. In the EU overall 73 % of the population are rejecting GM food (Eurobarometer 1999). When we look at specific countries, we see that Sweden, Spain, West Germany, Ireland, Belgium and Northern Ireland are close to the European average. An above-average rate of rejection can be found in Portugal, Austria, Denmark, France and Greece, with Greece showing the highest rejection rate with almost 85 %. Italy, Luxembourg, East Germany, Finland, Great Britain and the Netherlands are showing a below average rate of rejection, with the Netherlands and Great Britain (about 57 %) showing the lowest rejection rate in the European Union.

How can these considerable differences in attitudes towards genetical modification between Northern and Southern Europe be explained?

A review of literature shows that consumer attitudes towards genetically modified food are mainly focused on the influence of knowledge level and sociodemographic status.

Gloede, Bechmann and Hennen (Renn & Zwick 1997, pp. 45) expected to find that the overall attitude towards genetics is determined by sociodemographic factors such as age and education. They refused the hypothesis, that attitudes towards genetics are only related to a general attitude towards technology. However, they did not find any differences between the sociodemographic groups.

Hamstra (1995) investigated acceptance of Dutch consumers with regard to genetical modification of foods in three studies in 1991, 1993 and 1995. She examined product and

consumer characteristics as determinants of consumer acceptance and found that demographic factors had only little explanatory power, whereas the subjective perceptions of product characteristics were more important.

Miller (in Jaufmann & Kistler 1990, pp. 54) reported gender and ”science knowledge” as the main factors of attitudes towards genetics. According to his results, based on US data, women reject GM of food more than men. Persons with low educational attainment also show more rejection (Kistler & Jaufmann 1990). But Kistler & Jaufmann (1990) found that people in Europe with higher educational attainment or people a high level of information are more negative of genetics in food.

In other studies the general effect of knowledge and information about biotechnology and applications of biotechnology on the acceptance seems to be relatively low (Urban 1998; Urban & Pfenning 1999; Marlier in Durant 1992). This is confirmed by Frewer et al. (1994) who found a negative correlation between knowledge and attitude towards genetics, especially towards the evaluations of risks. The reason for this relationship is based on the fact that individuals with high levels of GM specific informations not only know more about GM but also are more aware of possible risks emerging from this technology.

This finding is supported by Pfister et al. who (Hampel & Renn 1999) stated that attitudes towards genetics are not rooted in knowledge. They found only a small correlation between knowledge and GM food acceptance.

All these studies had a national perspective. Only a recent study of Bredahl (2001) started to examine closer GM food attitudes in different countries. In four European countries (Denmark, Germany, Italy, and the United Kingdom) she investigated attitudes towards genetic modification in food production and purchase decisions with regard to genetically

modified yoghurt and beer. However, she applied a general, nation-independent attitude model in her study. So in relation to national differences she just replicated the finding that, generally, in Northern European Countries there is lower rejecton rate than in Southern European Countries. But she added the assumption, that the lower rejection in the Northern countries might be due to the fact that ”the entire debate on genetic modification is more advanced and more in focus in northern European countries than in many southern countries.” (Bredahl 2001). This view seems to be consistent with that of other authors, who interprete these differences as reflections of a cultural cleavage between the Northern and Southern countries of Europe (Hamstra 1991; Hoban & Kendall 1992). Two former Eurobarometer surveys confirm this view (Zechendorf 1994). In many respects, Germanic countries show similar attitudes about the facts of life as Romanic countries do. Irish attitudes strongly mirror those found in Southern Europe, as do Greek attitudes. Finnish attitudes, however, can be quite different from Scandinavians.

In sum, research on determinants of attitudes toward GM food is confined on sociodemographic and knowledge factors in a universalistic point of view. Even those researchers who acknowledge national differences do not provide empirical results which an fully explain cultural influences on GM food attitudes.

The goal of this paper is to look more closely on cultural determinants of attitudes towards GM food by examinig a general belief-attitude model in contrasting cultural contexts.

Following the binary comparison approach of Dogan & Pelassy, (1984, pp. 115), we will compare West Germany and Greece as cases of high socio-cultural contrast which might moderate the link between beliefs-attitudes. We do not include East Germany in our analysis,

because it can be assumed that East Germany still forms a specific cultural context of transformation in the year of data collection (1999) (see Brähler 1999). Thereby we assume to rely on a more homogeneous high industrialized culture as being contrasted to a mediterranean socio-cultural context of attitudes.

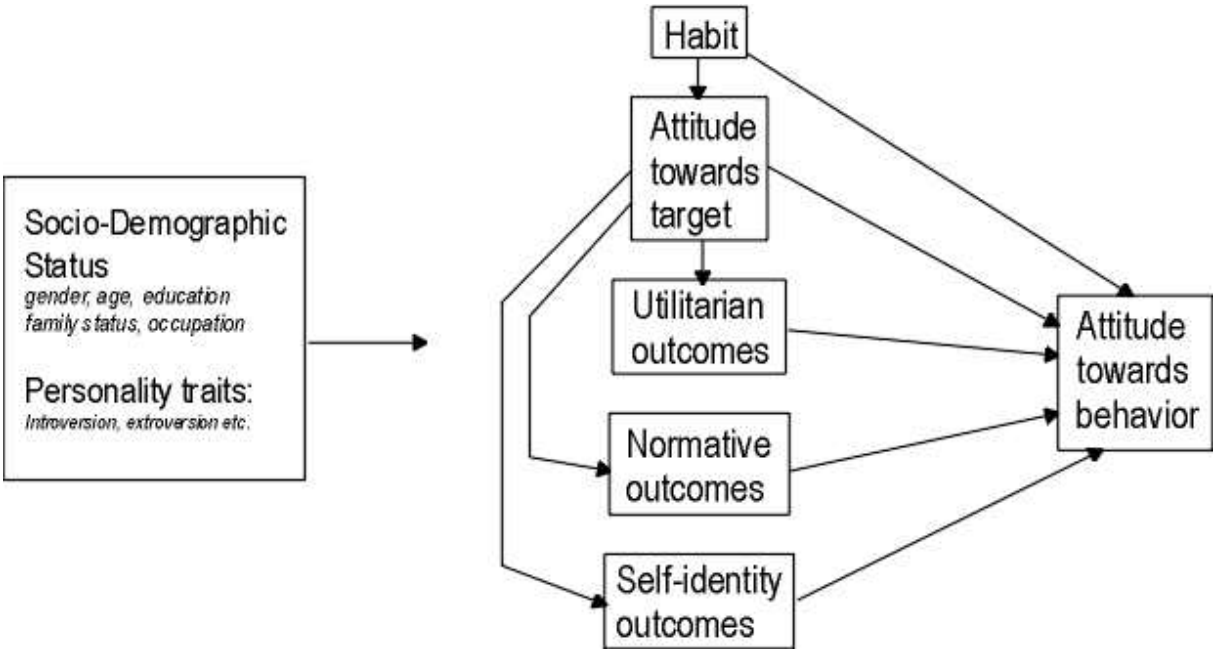
In the following we will first examine conceptually the relationship between cultural context and attitude formation. As a basic attitude model we refer to Eagly & Chaiken's composite attitude-behavior model. Cultural context is conceptualized in the framework of Hofstedes theoretical and empirical work on dimensions of cultural differentiation. By relating the cultural context approach with a psychological attitude concept and by taking into account contrasting cultural context profiles of Germany and Greece, we can formulate hypotheses on cultural differentiation of belief-attitude structures. The hypotheses are then tested with Eurobarometer 1999 data. At last, we will make some conclusions on the prerequisites of empirically analyzing cultural context effects on attitudes towards GM food.

2 Attitude structure and cultural context

Attitude structure

For a baseline model of attitude structure we choose the core attitude part of Eagly & Chaiken's (1993) composite attitude-behavior model (see figure 1). Accordingly, we define as attitude structure the interrelationship of an attitude (being the summative or overall evaluation of an object) and other cognitive elements, which are relevant for attitude formation.

Figure 1: A general attitude model



These cognitve elements are attitude towards targets, utilitarian outcomes (relating to the utililty of the behavior), normative outcomes (relating to significant others reacting on the behavior), and self-identitiy outcomes (relating to self-assertion).

Each of these cognitive elements is based on specific beliefs on anticipated attributes or outcomes of the object/behavior weighted by their subjective importance resp. desirability (subjective weights).

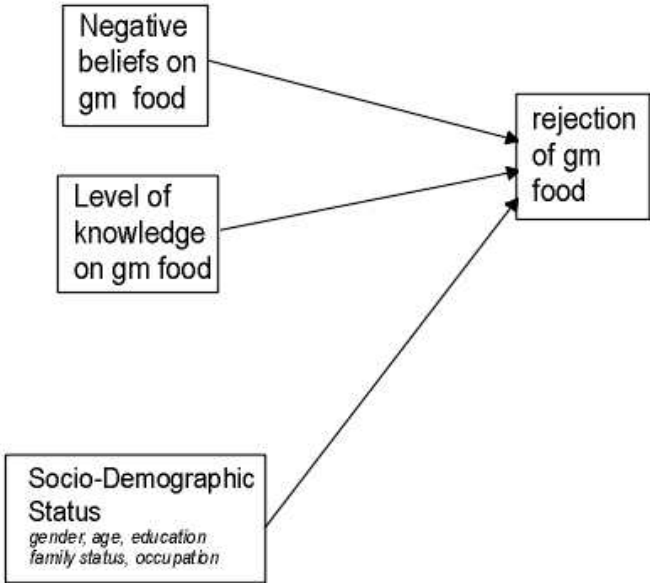
The cognitive meaning of "habit" is controversial and still not agreed upon, but it is acknowledged, that past experiences with the object or behavior has independent influence on further behavior.

Finally, the model takes into account that subjective outcomes, habits and attitudes towards targets are influenced by external variables of sociodemographic status and personality traits.

The specific cognitive object of the present study is GM food respective its Purchasing and Consuming. Because of data restrictions we confine the general attitude-behavior model on the belief-attitude part by modeling the attitude towards buying GM food as a function of negative beliefs on GM food. We also add individual knowledge on GM food into the model. Individual knowledge can be seen as a specific type of subjective beliefs because it is built up by subjective perception and acquisition processes. But because this type of belief has an objective, scientific base, to which public discussion and education is referred and which therefore is prominent for attitude change campaigns, it seems meaningful to treat it separately from other beliefs on GM food.

Finally, age, gender, educational and family status are also incorporated into the model as determinants of a rejective attitude towards GM food. These variables serve as controls, because their influence is assumed to be mediated by their covariation with subjective outcomes of identity assertion, social pressure, and attitudes towards targets (see figure 2).

Figure 2: a restricted model of rejecting GM food



On the basis of this model two general hypotheses can be formulated:

Hypothesis 1: The more negative the balance of beliefs on GM food, the more rejective the attitude towards GM food.

Hypothesis 2: The more knowledge on GM, the more rejective the attitude towards GM food.

The second hypothesis seems to be valid only under the assumption that there is no selective perception when people acquire knowledge on GM items. Knowledge in this context means cognitive access of scientific results on GM processes. And because of its natural science character, going into this type of knowing means, that overall not only benefits but also risks are getting more salient. People who learned about GM processes without selecting specific (positive or negative) features of GM, would generally be more conscious of the risks of GM in food production and therefore would tend to reject GM food.

Cultural context

Usually cultural differences are examined by comparing different cultures from a holistic point of view. This approach provides litte explanatory and predictive power, because national differences are traced back to one general cultural factor. Explaining differences between nations by their different cultures turns to be a tautology. 'National' is just replaced by 'cultural'.

We think, one can get a more effective understanding of cultural influences on the attitude structure by differentiating specific dimensions of the cultural context. In this understandig we will follow Hofstede's (1991) approach of "culture" as the mental programming of members of society, which means, that central aspects of everyday life activities, such as food for example information processing, eating manners and handling of food products are influenced by general evaluative prescriptions and behavioral and cognitive scripts.

Hofstede distinguishes between four general dimensions of guidance for cognitive and behavioral actions: power distance, uncertainty avoidance, individualism and masculinity. The specific combination of these dimensions defines a specific cultural context, which might be effective in determining attitudes and attitudinal structure. Accordingly, Hofstede's approach makes it possible to describe the different cultural contexts like that of Greece and Germany (West) as specific profiles of the four cultural dimensions (see table 1). West Germany seems to be a society with a comparatively more individualistic orientation, lower power distance and medium uncertainty avoidance, whereas Greece is characterized by higher powerdistance, more collectivistic, namely more familial orientation and higher uncertanity avoidance orientation. These are features of a society with more traditional patterns of orientation.

In relation to the masculinity orientation Hofstede did not find significant contrast between Greece and Germany.

Table 1: Profiles of cultural context in Greece and Germany

	Powerdistance	Individualism vs. Collectivism	Uncertainty avoidance	Masculinity vs. femininity
Germany	low (35)	High (67)	medium (65)	high (66)
Greece	medium (60)	Medium (35)	high (112)	high (57)

Source: Hofstede 1997: 30, 70f, 115f, 157f

From a socio-cultural point of view, these dimensions of cultural context provide social effective criteria for orientation and evaluation of individual behavior, which means that they influence attitude formation and attitude structuring processes in various domains of everyday life, especially in relation to food issues.

Power distance refers to the extent that members are socialized in accepting hierarchical inequality. Parents in Germany would raise their kids like their peers**,** whereas in Greece **c**hildren are used to and are expected to behave towards their parents, teachers and persons of authority with submission. In terms of the attitudinal model, one would expect that in a culture with more power distance (like Greece), peoples' attitudes are more dependent on social norms than in a culture with lower power distance. As in Greece familial relationships are especially regulated by social norms, one would expect that attitude formation is going on in familial interactions by adapting to the expectations of and information exchange with high status family members. Contrasting, in Germany with generally lower power distance, significant others' influence should be weaker in attitude formation. Instead, other, non-social factors, like scientific knowledge on GM processes should get more prominent in differentiating disapproving attitudes towards GM food.

Uncertainty avoidance means that ritual behavior and rules are important. People trust in experts, there is high need for consensus. In a situation with high uncertainty avoidance one would expect that people would not rely on their own personal beliefs related to GM food, but

more on the opionions of significant others. Therefore it is assumed that in Westgermany with lower uncertainty avoidance, personal beliefs should be more important for attitude formation than in Greece. Also, in an context where uncertainty tends to be avoided like in Greece, people would not rely in their knowledge on GM in food production, as it is characterized by high uncertainty of risks. People in Westgermany, which are more used to handle uncertainty, would more rely on their whatever uncertain knowledge on GM in food production than in Greece.

Individualism vs. collectivism points to the processes of self-evaluation and self-assertion. In individualistic societies, a positive self-evaluation depends on how goals and attitudes are reached and formed independent of others. In a collectivistic society in-group goals are prefered over individual goals. Thus, in Germany a society with wide spreading of individualization the core of the self-concept is to decide on behavior and attitudes by yourself, independent of others. Therefore, attitude formation should be based on the rational account of personally relevant benefits and risks of specific behavior like purchasing GM food. So scientific knowledge should be a more important factor in forming attitudes in West Germany than in Greece.

In Greece the self-identity refers heavily to the social esp. family network. Persons are strongly tied to family and kinship groups. So, one would expect, that persons, when forming their attitudes towards significant objects like GM food, would mainly rely on beliefs and perceptons, which carry on family norms and traditions.

In sum, we can formulate the following three hypotheses on the influence of cultural contexts on attitude structuring in West Germany and Greece:

H3: In the westgerman cultural context, which is characterized by lower powerdistance, more individualism and lower uncertainty avoidance, individual negative beliefs are more important for attitudes towards GM food than in Greece.

H4: In the westgerman cultural context the level of knowledge on GM processes in food production is more important for forming (rejective) attitudes towards GM food than in Greece.

H5: In the westgerman cultural context personal characteristics like negative beliefs, level of scientific knowledge, as well as sociodemographic attributes are more effective on individual attitude formation than in Greece.

3 Data and Method

Data and operationalisation of the variables

Data of the Eurobarometer 52.1 (1999) has been used for modelling the relationship between attitude, beliefs and knowledge and sociodemographic factors. This opinion poll was carried out in fifteen Member States of the European Union, between November, 1st and December, 15th 1999, within the framework of the Eurobarometer, at the request of the European Commission´s for Research. This survey is the fourth in a series of Eurobarmeter studies covering the same subject. Data of Greece and West Germany were used, which encompassed 1000 respondents each. The samples consist of randomly selected subjects aged 15 years and older in each country.

The functional relationship of attitude, beliefs and knowledge is estimated as logistic regression, because of the binary coding of the dependent variable. Logistic regressions is

adequate for analyzing dependent variables with binary response. For easier interpretation of the quantitative size of the effects on the dependent variables, the ”odds-ratios” of the predictor weights are reported.

The dependent variable

As the Eurobarometer was not designed explicitly according the attitudinal model, only one item expressing ”favorability” resp. ”likeability” of GM food was found to be useful as indicator of the attitude towards GM food. It was the item ”I dread the idea of GM food”, which was rated by the respondents on a five point agreement scale, ranging from ”total agreement” (=1) to ”total disagreement” (=5). Code 3 meant ”nor agree neither do not agree”, additionally there was a ”do not know” category. The scale responses were transformed into a binary response variable by collapsing ”totally disagree” and ”disagree” into one response category and ”totally agree” and ”agree” into an opposite response. Subject with responses on ”neither nor agree/disagree” and on ”do not know” were excluded from the analysis because we assumed them to reflect non-attitudes (Converse 1970) . By this data handling we tried to heighten reliability of the comparative analysis.

The independent variables

In terms of our model, attitude towards GM food (which means the level of subjective rejection of GM food) is determined by socio-economic as well as by cognitive factors such as belief and knowledge on GM food.

Eurobarometer items concerning GM food were analysed by factor analysis, which indicated a group of items belonging to one belief type factor, encompassing negative beliefs on GM food. Factor analysis was run separately for Greece and Germany, revealing that the factor was the same in each country and supporting the assumption that underlying psychological

constructs were the same (Van de Vijver & Leung 1997). The value of alpha (.85) showed high reliability of the belief factor.

Negative beliefs and level of knowledge on GM food

A list of items were used to indicate the knowledge level of the respondents on bioechnological aspects of GM food (see Appendix). Following Urban & Pfenning (1996), classes of knowlegde were defined by taking into account that correct answers can occur by chance and therefore the expected value for the propotion of correctly answered questions will be 50% for dichotomous response categories. Accordingly the knowledge level was classified as follows:

Low knowledge (less than 50% correctly answered questions)

Medium knowlegde (50-75% correctly answered questions)

High knowlegde (more than 75% correctly answered questions)

In table 4 belief and knowledge indicators are summarized.

Table 4: Indicating negativ belief and extent of knowledge on GM food

original variable EB 52.1	**variable in the model**	**categories**	**comments**
- GM Food threatens the natural order of things - GM Food is simply not necessary - Even if GM Food had benefits it is fundamentally unnatural - If anything went wrong with GM Food it would be a worldwide catastrophe	Belief	1 = disagree, totally disagree 0 = agree, totally agree Missing = don't know, neither agree nor don't agree	Measures the extent of rejective beliefs on a 5-point scale. Agreement means high rejection
(see Appendix)	Knowledge	1 = low 2 = medium 3 = high Missing values = don't know	Measures the extent of knowledge by taking into account the number of correctly answered questions.

Source: own presentation

Sociodemographic status

Several indicators of the respondent's socio-economic and demographic status were available in Eurobarometer. They were also included in our model in spite of the findings in former research as control variables.

They are summed up in table 5.

Table 5: Indicating socio-economic and demographic status

Variable in the model	Categories	Comments
Family status	1 = no kids 0 = Kids	0 summarises the categories 1, 2, 3, more than 4 Kids
Marital status	1 = married 0 = not married Missing values = others	Category 1 consists of people who are married, re-married, living together category 0 consists divorced, living separated, never stayed with another person, at the moment alone, widowed
Gender	1 = female 0 = male	
Educational status	low = up to 15 years medium = 16-19 years high = more than 20 years Missing = Student	Takes into account the age a person quit fulltime education
Employment status	1 = working 0 = not working	
Income position	-- = very low - = low + = good ++ = very good Missing values = don't know, no answer	Total wages and salaries per month of all members of the household
Age	1 = 15-24 Years 2 = 25-34 Years 3 = 35-44 Years 4 = 45-54 Years 5 = 55-64 Years 6 = 65 +	

Source: own presentation

In the section devoted to sociodemographic variables, the reader will come across constructed variables, such as education level and income level. Given the heterogeneity of

the education systems, it was decided to establish subjective education thresholds in the Eurobarometer. The first level is ”low”, which covers those who left school at or before the age of 15, the second level is average, ” medium”, which includes those who completed their education between the ages of 16 and 19 and the third level is ”high”, which covers those who ended their studies after the age of 19. The same difficulty had to be overcome with regard to income scale. The solution adopted divides the scale into quartiles and groups together the results of each country in a European scale consisting of four levels.

4 Results

As we can see in column 2 of table 6, the general hypotheses H1 seems to be confirmed. We find a significant positive effect of negative beliefs on the probability of rejecting GM food.

But if we look on the negative belief effect separately for Greece and Germany we find differences. In Germany negative utility beliefs determine to some part the rejective attitude towards GM food. But for the greek case we expected to find no differences between people with lot of or little negative expectations on consequences by GM food production (see H3). However, here we also find a highly significant and very strong beliefs effect on the negative attitude towards GM food. In fact, the negative beliefs seem to be the only factor of influence on the attitudinal response in a model also with sociodemographic status variables. In Germany gender, age and family status also are contributing to the rate of rejecting GM food.

Table 6: Odds ratio: Effects of knowledge and negative beliefs on rejecting GM food[1]

reference group	*predictor*	Greece / West Germany	West Greece	West Germany

low knowledge	medium knowledge level	n.s.	n.s.	n.s.
	high knowledge level	,36***	n.s.	,19***
disagree in negative beliefs	agree in negative beliefs	3,53***	20,18***	2,52***
	Nagelkerkes R^2	,31	,27	,44

Source: own calculations, Eurobarometer 52.1, *** significant 1%-Niveau, * 5%-Niveau
[1] column 4 and 5 controlled for: age, education, gender, employment status, family status, kids present
column 3 controlled for: age, education, gender, employment status, family status, kids present, nation

In relation to H2 our results are not confirming. We find that people with high knowledge have a smaller probability of rejecting GM food than people with low knowledge. But this general effect is not valid, when we look for Germans and Greeks separately. We find, that the effect of high knowledge level on rejecting GM food is only valid for Germans. For greek people we do not find significant rejection rate differences with less and more knowledged people. This seems to confirm our hypothesis H4 on the effects of a more traditional cultural context of Greece. The negative knowledge effect is highly significant and very strong in Germany. Thus, our hypothesis H4 only partially found empirical support.

Finally, hypothesis 5, which predicted more explained variance in the model of Germans' rejection of GM food, is consistent with our results. The total regression model including sociodemographic status variables explained 44 percent of the variance in the german case, whereas in the greek case only 27 percent of the variance was explained (mainly by the strong negative belief effect).

5 Conclusions

Applying differentiated cultural context effects on the attitude formation structure seem to be meaningful from a theoretical point of view. In our theoretical reasoning we argued that only in modern societies with cognitive and behavioral orientations, which are defined by high

individualization, low powerdistance and low uncertainty avoidance, high level of knowledge, negative beliefs and other personal status factors should determing the formation of rejective attitudes towards GM food. The attitude structure, which means the interrelation of attitude and attitudinal determinants should be more differentiated is type of cultural contexts. This theoretical reasoning was partly confirmed by our results.

For societies like Greece with more traditional pattern of orientation we expected a more undifferentiated structure of rejective attitude towards GM food, because of high family collective orientations, high powerdistance and lower uncertainty avoidance. Taking the explained variance as a proof, we could find empirical support for this hypothesis, which adds further evidence to similar results as they were reported by Bagozzi et al. (2000).

In relation to the knowledge effect the cultural context hypothesis is consistant with the empirical result. Only for modern orientation pattern like that we assumed to be prevalent in Westgermany, knowledge is important for forming the rejection attitude. But in contradiction to the results reported by research we found that high level of knowledge seems to reduce rejection of GM food in Westgermany. Possibly one could take this as a hint for a self-selection process: people in Westgermany who, because of their low uncertainty avoidance have a positive attitude towards GM and therefore are more interested in GM processing of food leading to more access of knowledge of GM processing.

In relation to the belief effect on rejection of GM food our hypothesis of cultural effect failed. We found the belief effect both in Westgermany and Greece but much stronger in Greece than in Westgermany. So we found the opposite of our hypothesis. But if we take this results together with the fact that in the greek case the negative belief is the only factor on which the rejection attitude is based then a hypothesis on the effect of traditional orientation seems to be consistant with the results. We could assume that in this case uncertainty avoidance is the

overwelming cognitive context for forming a negative attitude. In this perspective Greeks seem to rely only on that what they personally believe. In a society with high uncertainty avoidance they generally are sceptical of new technologies which are far beyond of traditional agricultural practices of food production.

In sum the results of our analysis show that theoretically it is promising to connect cultural differentiation theory with general attitude modelling. It can lead to a deeper and more precise understanding of cultural differentiation as well as to a more valid cross-cultural theory of rejection attitude formation.

Because of the restricted database of a general survey data, the empirical validation remains partly undecisive. More adequat data for differentiated empirical testing are needed.

Appendix

Knowlegde questions to be answered with true, false or don´t know

1. There are bacteria which live from wasted water
2. Ordinary tomatoes do not contain genes while genetically modified tomatoes do
3. The cloning of living things produces exactly identical offspring
4. By eating a genetically modified fruit, a person's genes could also become modified
5. It is the father's genes that determine whether a child is a girl
6. Yeast for brewing beer consists of living organisms
7. It is possible to find out in the first few months of pregnancy whether a child will have Down's Syndrome
8. Genetically modified animals are always bigger than ordinary ones
9. More than half of the human genes are identical to those of chimpanzees

10. It is impossible to transfer animal genes into plants
11. Criminal tendencies are mainly genetically inherited
12. Musical abilities are mainly learned

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